

High Level Waste Insights for Reprocessing Spent Fuel -11462

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ABSTRACT

This paper will address the waste classification of solid waste from recycling of spent nuclear fuel. It will provide a history of the regulatory development of the definitions of high-level radioactive waste (HLW) and waste incidental to recycling (WIR or incidental waste) and the basis for concluding that WIR is not HLW. The development of the definitions of HLW and WIR provides support for the definitions in proposed 10 CFR Part 7x of HLW and WIR that have been submitted by the Nuclear Energy Institute Regulatory Recycle Task Force to the Nuclear Regulatory Commission (NRC) for a regulatory framework to support recycling of spent fuel. As will be explained in the paper not all waste from recycling should be considered HLW.

I. INTRODUCTION

This paper addresses the waste classification of solid waste from reprocessing of spent fuel.¹ It reflects the authors' experiences while working at the Nuclear Regulatory Commission (NRC) as well as our experiences as consultants to the Department of Energy (DOE) and the Nuclear Energy Institute's Regulatory Recycle Task Force that was charged with the challenge of developing a regulatory framework to support the recycling of spent fuel. The Nuclear Energy Institute (NEI) submitted a draft regulatory framework as a proposed 10 CFR Part 7x to the NRC in December 2008 which is being considered as part of the NRC effort to develop a rule to regulate future recycling facilities.² An element of the NEI proposed framework was the treatment of reprocessing waste which necessitated defining the terms "high-level waste" and "waste incidental to recycling." NEI also provided the NRC a white paper that the authors of this paper developed to support these definitions in the framework which formed the basis for this paper.³

By way of background, there has been limited commercial reprocessing in the United States which occurred in the 1970s at the West Valley facility in New York. However, there has been substantial reprocessing done by the DOE at its facilities Washington, Idaho, and South Carolina. As a result of these reprocessing activities, reprocessing liquids have been stored in tanks for many years. The four sites are in various stages of decommissioning and remediation that involve the treatment and disposal of the wastes in these tanks. This paper focuses on the process of determining the classification of the waste as either high-level radioactive waste (HLW) or waste incidental to recycling (WIR or incidental waste).

¹ This paper uses the terms reprocessing and recycling interchangeably.

² Part 7x is the proposed regulatory framework contained in Appendix A of the NEI December 19, 2008 "White Paper" submitted to the NRC. Available at NRC ADAMS at ML083590129 (December 24, 2008).

³ "High Level Waste Insights" available at NRC ADAMS at ML093030353 (November 12, 2009).

II. Development of the Definition of HLW and WIR

1. Appendix F to 10 CFR Part 50

The first regulatory definition of HLW was issued by the Atomic Energy Commission (AEC) in 1970. This definition was incorporated into 10 CFR Part 50, Appendix F, Policy Relating to the Siting of Fuel Reprocessing Plants and Related Waste management Facilities. Appendix F defined HLW as:

those aqueous wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuels.

The intent of the AEC was to “permanently removing these wastes from man’s biological environment ... disposal in deep geologic formations.” 35 FR 17530, 01 (November 14, 1970). Appendix F does not define all waste associated with reprocessing as HLW needing geologic isolation. In fact, the proposed Appendix (34 FR 8712 (June 3, 1969)) provided that certain reprocessing waste did not have to be disposed of as HLW. It provided that:

6. Radioactive hulls and other irradiated and contaminated fuel structures hardware may be disposed of by one of the following methods:
 - (a) Disposal in the same manner as high-level waste; or
 - (b) Disposal at a licensed waste burial facility located on land owned by the Federal Government or by a State government as required by § 20.302 [predecessor of Part 61] of this chapter.
7. Other solid wastes resulting from operation of commercial fuel reprocessing plants, such as ion exchange beds, asphalted sludges, vermiculated sludges, and contaminated laboratory items, clothing, tools, and equipment must be disposed of in accordance with Commission regulations for disposal of such material in Part 20 of this chapter (e.g., disposal at a licensed waste burial facility located on land owned by the Federal Government or by a State government).

The source of the contamination for the material in paragraph 6 does not fit the Appendix F definition of HLW as the contamination occurred prior to reprocessing. The contamination in the material in paragraph 7 is from the reprocessing process.

The final rule did not include these two paragraphs that related to the disposal of radioactive hulls and other solid waste resulting from the operation of fuel reprocessing plants. AEC’s explanation for deleting paragraphs 6 and 7 was that it had undertaken studies concerning the disposal of wastes contaminated with plutonium and other transuranium nuclides that may result in rulemaking identifying certain radioactive materials that might be unsuited for disposal at licensed land burial facilities. Final Rule, 35 FR 17530, 17532 (November 14, 1970). Although these paragraphs were not adopted, the NRC has not considered the items in them to be HLW as Appendix F addressed

[H]ighly concentrated (and hazardous) waste containing virtually all of the fission product and transuranic elements (except plutonium) present in irradiated reactor fuel. The term does not include incidental wastes resulting from reprocessing plant operations such as ion exchange beds, sludges, and contaminated laboratory items, clothing, tools, and equipment. Neither are radioactive hulls and other irradiated and contaminated fuel structure hardware within the Appendix F definition.¹

FN1 See 34 FR 8712, June 3, 1969 (notice of proposed rulemaking), 35 FR 17530 at 17532, November 14, 1970 (final rule). Incidental wastes generated in further treatment of HLW (e.g., decontaminated salt with residual activities in the order of 1,500 nCi/g Cs-137, 30 nCi/g Sr-90, 2 nCi/g Pu, as described in the Department of Energy's FEIS on long term management of defense HLW at Savannah River Plant, DOE/EIS-0023, 1979) would also, under the same reasoning, be outside the Appendix F definition.

(Emphasis added). Advanced Notice of Proposed Rulemaking, Definition of "High-Level Radioactive Waste," 52 FR 5992, 5993 (February 27, 1987). NRC has, therefore, taken the view that Appendix F excluded from HLW what is now called WIR.⁴ DOE has also considered the items described in paragraphs 6 and 7 of the proposed Appendix to be incidental radioactive material by citation. Chapter II.B(1) of DOE Manual 435.1.

2. Marine Protection, Research, and Sanctuaries Act of 1972

The first statutory definition of HLW appeared in the Marine Protection, Research, and Sanctuaries Act of 1972 (Marine Protection Act), 33 USC 1402(j). In that statute, Congress adopted the definition that AEC used in Appendix F to 10 CFR Part 50 but added to the AEC definition "irradiated fuel from nuclear power reactors." HLW was defined as:

the aqueous waste resulting from the operation of the first cycle solvent extraction system, or equivalent and the concentrated waste from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuels, or irradiated fuel from nuclear power reactors.

The definitions in both the Marine Protection Act and Appendix F focused primarily on the source of waste, i.e., material left after reprocessing, rather than the waste's constituents or radiological properties.⁵ In the Energy Reorganization Act of 1974 (ERA), the statutory language for Section 202 addressed the regulation of "high-level radioactive waste," but did not define it. The NRC took the view that the definitions in Appendix F and the Marine Protection Act for HLW applied to the ERA.⁶

3. West Valley Demonstration Project Act

⁴ Denial of Petition for Rulemaking, 58 FR 12342, 12343. (March 4, 1993).

⁵ History and Framework of Commercial Low-Level Radioactive Waste Management in the United States, NUREG 1853 at B-3 (2007).

⁶ 52 FR at 5993. See also Denial of Petition for Rulemaking, 58 FR 12342 (March 4, 1993).

In 1980, Congress provided another definition of HLW in the West Valley Demonstration Project Act (WVDPA) (PL 96-368). In the WVDPA the term “HLW” was defined as:

the high level radioactive waste which was produced by the reprocessing at the Center of spent nuclear fuel. Such term includes both liquid wastes which are produced directly in reprocessing, dry solid material derived from such liquid waste, and such other material as the Commission designates as high level radioactive waste for the purposes of protecting the public health and safety.

NRC has taken the view that the definition in the WVDPA is equivalent to the definition in Appendix F. 52 FR at 5993. NRC has also concluded that the WIR concept is applicable to the West Valley site such that WIR is not part of HLW under the WVDPA. Decommissioning Criteria for the West Valley Demonstration Project at the West Valley Site, 67 FR 5003, 5011 (February 1, 2002).

4. 10 CFR Part 60

In 1981, the NRC developed a definition of HLW as part of its promulgation of 10 CFR Part 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories.” NRC defined HLW as

(1) Irradiated reactor fuel, (2) liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel, and (3) solids into which such liquid wastes have been converted.

This definition used the definition from Appendix F with the addition of spent fuel and focused primarily on the source of the waste.

5. Nuclear Waste Policy Act of 1982

Shortly after Part 60 was promulgated, Congress adopted the Nuclear Waste Policy Act of 1982 (NWPA). (42 USC 10101). Section 2 of the Section 2(12) of the NWPA defined HLW as

(A) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and
(B) other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation. (emphasis added)

Congress in 1988 amended the Atomic Energy Act of 1954 (AEA) to define the term “HLW” adopting the same definition that was in the NWPA.

The NWPA departed from the past definitions that focused primarily on the source of the waste when it added the language underlined above that is associated with the hazard of HLW. It is clear that the intent of clause A of the NWPA definition was to consider both the source and the hazard. The source of HLW is waste from reprocessing, but waste from reprocessing is not the

sole criteria for determining if waste is HLW. The NWPA also included the hazard. The hazard was reflected by the “highly radioactive” and “sufficient concentration” language. A cardinal rule of statutory interpretation is that no word is to be ignored so that the hazard language needs to be utilized in determining what waste is HLW. Thus, while the source of HLW is reprocessing, not all liquid waste produced directly in reprocessing and any solid material derived from such liquid waste is HLW. HLW is only that waste which is “highly radioactive” and of “sufficient concentration. While the terms “highly radioactive” and of “sufficient concentrations” are not defined, clause B of the definition is instructive because it builds into the HLW definition the concept of a need for geologic isolation as the fundamental standard for HLW.

The language used in the definition is not accidental. HR 3809 as reported by the House Committee on Interior and Insular Affairs did not contain language to address the hazards of HLW. The “sufficient concentration” language in the definition was added by the House Armed Services Committee. It modified the previous bill language by adding hazard language as follows:

The term “high-level waste” means the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products and transuranic wastes in such concentrations that the Administrator determines by rule that such products and waste requires permanent isolation.

The Committee explained this change as follows:

This amendment strikes out the definition of the term “high-level radioactive waste” contains in the bill ... and substitutes a new definition of the term “high-level radioactive waste.” The recommended definition takes into consideration both the source and the hazard of the waste and permits the regulatory agency responsible under law for setting standards for radioactivity (EPA) to determine the concentration of fission products and transuranic elements that require permanent isolation.

H.R. Report.97-491, Part II, at 2 and 4 (July 16, 1982) reprinted at 1982 USCAAN 3837 and quoted in (emphasis added). Further support of Congressional intent is demonstrated by a letter that is included in the House Armed Services Committee’s report submitted by DOE that stated

[T]he Department believes that the definition of “high-level radioactive waste” should reflect not only the source of waste (e.g., from reprocessing,) but also the relative hazard. Such a definition would permit the regulatory agencies to exclude materials from “high-level radioactive waste” that need not be disposed of in a repository because of low activity.

Id at 17, reprinted in 1982 USCCAN 3847-3849.

This clearly shows the intent was to permit consideration of both the sources and the hazard of radioactive waste from reprocessing. As finally enacted the definition was placed into two

clauses and the NRC replaced the EPA as the regulatory authority. The Department of Justice (DOJ) shares this view. In the U.S. Government's brief submitted to the Court of Appeals in the NRDC litigation involving DOE Order 435.1⁷ DOJ stated that "Nothing in the legislative history, however, shows that these changes were intended to alter or eliminate the authority to consider both the source and hazard of the waste."⁸

While one might argue as the Government did in the NRDC litigation that the NWPA's definition of HLW considers the concentration of fission products in both liquid waste produced directly in reprocessing and in the solids derived from that waste,⁹ it is unnecessary to address the application to liquids since generally only solid waste can be disposed of in licensed disposal sites under 10 CFR Part 61. Accordingly, the focus in this paper is on solid waste that is derived from liquids. This would include the solids resulting from processing reprocessing liquids for storage and transportation as well as the sludge in tanks whose source is reprocessing liquids.

6. NRC 1987 Advanced Notice of Proposed Rulemaking

In 1987, the NRC issued an Advanced Notice of Proposed Rulemaking, Definition of "High-Level Radioactive Waste," 52 FR 5992, 5993 (February 27, 1987). The question presented in that notice was whether the NRC should clarify the definition of HLW in clause A of the NWPA by (1) setting numerical limits to define "sufficient" concentrations to distinguish HLW from non-HLW or (2) define HLW to equate the waste in clause A to what has been traditionally considered to be HLW under Appendix F. In addition, the NRC considered how it should exercise its authority to define other material as HLW. As a result of the differing views expressed in the comments it received, the Commission abandoned its effort to define numerically HLW and adopted the traditional approach used for the ERA which would include "the primary reprocessing waste streams at DOE facilities, though not the incidental wastes produced in reprocessing."(emphasis added). Proposed Rules for Disposal of Radioactive Wastes, 53 FR 17709 (May 18, 1988). This proposed rulemaking resulted in the current rules on greater than Class C waste (GTCC) found in 10 CFR 61.55(a) (2) (iv).

7. Petition to Define HLW

In 1990, the States of Oregon and Washington and the Yakima Indian Nation petitioned the NRC to define the definition of HLW to determine whether certain DOE waste at Hanford was HLW. In denying the petition, NRC established for the first time specific criteria for incidental waste from reprocessing that would not be HLW. These criteria were:

⁷NRDC v. Abraham, 271 F.Supp.2d 1260 (D. Id. 2003) and 388 F. 3d 701 (9th Cir. 2004).

⁸ Appeal Brief: Appeal from a Final Judgment of the United States District Court for the District of Idaho (271 F. Supp 2d. 1260), 9th Circuit No. 03-35711, at page 45 (January 29, 2004).

⁹ The brief further stated that "DOE believes that the NWPA is better interpreted to allow the agency to consider the concentration of fission products in both liquid waste produced directly in reprocessing and in the solids derived from that waste." "When several words are followed by a clause which is applicable as much to the first and other words as to the last, the natural construction of the language demands that the clause be read as applicable to all" cites omitted. FN 7 of Appeal Brief. The brief also stated that "since the solids are derived from the liquids, they are likely to share chemical and physical characteristics, making it much more likely that congress intended DOE to have the authority to assess the concentration of fission products in both." Id. Moreover, solids may have higher concentrations than liquids.

- 1) The wastes have been processed (or will be processed) to remove key radionuclides to the maximum extent that is technically and economically practical;
- 2) The wastes will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR Part 61; and
- 3) The wastes are to be managed, pursuant to the Atomic Energy Act, so that safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C are satisfied.¹⁰

8. DOE Order 435.1

In July 1999, DOE issued Order 435.1 on Radioactive Waste Management (July 9, 1999, revised August 28, 2001) along with its Radioactive Waste Manual (July 9, 1999, revised June 19, 2001) that defined WIR. DOE adopted two processes to determine if reprocessing waste should be WIR or HLW. The citation process adopted the waste described in paragraphs 6 and 7 of the 1969 AEC proposed Appendix F (34 FR 8712 (June 3, 1969)). For the evaluation process, DOE used the following criteria for waste to be WIR:

- 1) Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical;
- 2) Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*; and
- 3) Are to be managed, pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, and in accordance with the provisions of Chapter IV of this Manual, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize.

(emphasis added). The criteria DOE adopted was similar to the 1993 NRC WIR Criteria with one significant addition which has been underlined. The significance of the underlined portion of the criteria is discussed below under the NRDC litigation. DOE uses the criteria in Order 435.1 for both on-site and off-site disposal.

It should be noted that DOE is in the process of updating Order 435.1.

9. NRC Savannah River Review

On December 19, 1999, the NRC staff submitted SECY 99-284, Classification of Savannah River Residual Tank Waste as Incidental, to the NRC Commission seeking authorization to provide a response to the DOE on its request for NRC to review DOE's decision to classify

¹⁰ 58 FR at 12345; The criteria were approved by the Commission in an SRM dated February 16, 1993, in response to SECY-92-391, "Denial of PRM 60-4 - Petition for Rulemaking from the States of Washington and Oregon Regarding Classification of Radioactive Waste at Hanford," and described in a letter from R. Bernero/NRC, to J. Lytle/DOE, dated March 2, 1993 (1993 NRC WIR Criteria).

certain waste in tanks at Savannah River as WIR. The staff's approach was to use the three criteria of the 1993 NRC WIR Criteria. However, the Commission in its SRM dated May 20, 2000 directed the staff to modify its response to

delete all discussions of, and references to, the specific radionuclide concentration limits based on 10 CFR 61.55 proposed by the staff, and also [the response] be revised to reflect the following views:

The letter should be modified to avoid strictly applying the criteria developed for the Hanford site to Savannah River. Rather, the staff should take a more generic, performance-based approach. In this regard, the Commission could support DOE's proposed methodology as long as the first and third criteria are satisfied. In effect, DOE would undertake cleanup to the maximum extent that is technically and economically practical and would demonstrate that it could meet performance objectives consistent with those which the Commission demands for the disposal of low-level waste. These commitments, if satisfied, should serve to provide adequate protection of the public health and safety and the environment. The staff should not designate alternative concentration limits for wastes that would exceed Class C limits. Rather, DOE should be encouraged to develop concentration limits -- in effect to develop a site-specific alternative to criterion 2 -- in order to bound the analysis and to provide a firm benchmark for satisfactory cleaning of the tanks.

This decision focused WIR in two criteria. The first involved the removal of key radionuclides to the maximum extent that is technically and economically practical and the second involved meeting the performance objectives of Part 61. In the Commission's view meeting the performance objectives of Part 61 demonstrates that near surface disposal of the waste is protective of the public health and safety. If waste from reprocessing can be disposed of safely in a near surface disposal site, then there is no need to treat the waste as HLW and dispose of it in a geologic repository. The removal of the key radionuclides adds further protection by reducing concentrations.

10. 10 CFR Part 63

In 2001, the NRC again considered the definition of HLW as part of its rulemaking on 10 CFR Part 63, Disposal of HLW in a Geologic Repository at Yucca Mountain, Nevada. The proposed rule used the language in the Part 60 definition for HLW. 64 FR 8640 (February 22, 1999). However, it was recognized that the NRC definition was different than the EPA definition in 40 CFR 197.2. The EPA had adopted the definition of HLW used in both the AEA and NWPA. In the Statement of Considerations for the final rule, the NRC stated that "The Commission believes there is no substantive difference between the two definitions and has modified its definition to more closely reflect the definition provided in the Nuclear Waste Policy Act of 1982 and the final [EPA] standards." 66 FR 55732, 35 (November 2, 2001). The resulting rule provided:

- (1) The highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and

- any solid material derived from such liquid waste that contains fission products in sufficient concentrations;
- (2) Irradiated reactor fuel; and
 - (3) Other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation.

11. NRC West Valley Decommissioning Criteria

On February 1, 2002, NRC published its Decommissioning Criteria for the West Valley Demonstration Project (67 FR 5003). In addressing WIR, the NRC stated:

Since 1969, the Commission has recognized the concept of waste incidental to reprocessing, concluding that certain material that otherwise would be classified as HLW need not be disposed of as HLW and sent to a geologic repository because the residual radioactive contamination after decommissioning is sufficiently low as not to represent a hazard to the public health and safety. Consequently, incidental waste is not considered HLW.

(emphasis added). 67 FR at 5009.

The NRC established the following WIR criteria similar to the criteria used in Savannah River to guide the classification of waste that is applicable to both the DOE site remediation and New York State Energy Resources and Development Authority (NYSERDA) when the site reverts back to its control under an NRC license:

- (1) The waste should be processed (or should be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical; and
- (2) The waste should be managed so that safety requirements comparable to the performance objectives in 10 CFR part 61 subpart C, are satisfied.

Both NYSEDA and the New York State Department of Environmental Conservation (NYSDEC) questioned the NRC as to why it removed the criterion from the 1993 NRC WIR Criteria that set a limit of Class C concentrations for incidental waste. In response to NYSEDA, NRC Chairman Richard A. Meserve stated:

NYSEDA correctly states that the criteria for WIR determinations at Hanford included the criterion that the waste "...not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR Part 61." This criterion does not appear in the Commission's incidental waste criteria for West Valley. When the Commission considered the incidental waste issue at Savannah River, this criterion was dropped because the Commission adopted a risk-informed and performance-based approach to meeting the performance objectives in Part 61 that focuses attention on the potential health consequences of leaving waste on-site (i.e., doses which might occur), rather than considering more indirect measures of health risk, such as meeting specific radionuclide concentration limits. The Commission has adopted this same approach for West Valley. In effect, DOE should undertake cleanup to the maximum extent that is technically and

economically practical and should achieve performance objectives consistent with those that the Commission demands for the disposal of low-level waste.

(emphasis added).¹¹

In response to NYSDEC, John Greeves, NRC Director of Waste Management, stated:

In 1993, NRC included a WIR provision that the concentration of the residual radionuclides removed from tanks and disposed of as low-level waste not exceed the applicable concentration limits for Class C waste. However, more recently in 2000, the Commission did not include that provision in the advice it gave DOE on Savannah River tank closure. [NRC Staff Requirements Memorandum, “SECY-99-0284, Classification of Savannah River Residual Tank Waste as Incidental,” May 30, 2000] In our view, while the concentrations and potential heterogeneity of wastes must be appropriately represented in the dose modeling, the physical processes associated with mobilization of wastes can result in instances where ultimate mobilization rates are not controlled by waste concentrations. Consequently, the NRC does not believe that the concentration of material is a sufficiently direct measure in WIR determinations from a public health and safety perspective that it should be a controlling element in WIR determinations. As noted in the Final Policy Statement, the Commission is taking a risk informed performance-based approach that focuses on dose as the measure of protection for the public, an approach which allows:

“DOE the flexibility to develop innovative approaches to meeting the performance objectives in Part 61. In effect, DOE should undertake cleanup to the maximum extent that is technically and economically practical and should achieve performance objectives consistent with those we demand for the disposal of low-level waste. If satisfied, these criteria should serve to provide protection of the public health and safety and the environment and the resulting calculated dose would be integrated with the resulting calculated doses for all other remaining material at the NRC-licensed site.”

(emphasis added).¹²

12. NRDC Litigation

It wasn't until 2003 that the WIR issue was litigated. In 2003, a Federal District Court issued a decision addressing the claim of NRDC that DOE Order 435.1 was invalid as it exceeded DOE's authority under the NWPA. NRDC v Abraham, 271 F. Supp 2d.1260 (D. Idaho2003).¹³ The Court recognized that the NWPA allows DOE to treat solids to remove fission products thereby permitting reclassification of the waste. This would include the sludges in tanks. However, the Court concluded that DOE had ignored the word “include” in the definition of HLW and that “sufficient concentration” only applied to solids. Id. at 1265. The Court also stated that the

¹¹ Letter from Chairman Meserve to Dr. Piciulo, Director NYSERDA, dated June 20, 2002 (ML021420085).

¹² Letter from John Greeves to Paul Merges, NYSDEC, dated October 8, 2002 (ML022120257).

¹³ NRDC did not challenge the Citation methodology under DOE Order 435.1.

second 435.1 criterion associated with the performance objectives had no independent meaning stating “DOE will treat waste that it deems to be low-level waste as low-level waste.” Id. Significantly, the Court was concerned with the provision in 435.1 that allows DOE “to meet such alternative requirements for waste classification and characterization as DOE may authorize.” The Court stated that such “alternative requirements” are not defined and “thus are subject to the whim of DOE.” Id. The Court held DOE Order 435.1 invalid because it conflicts with the HLW definition of the NWPA. The NWPA

definition pays no heed to technical or economic constraints in waste treatment. Moreover, NWPA does not delegate to DOE the authority to establish “alternative requirements” for solid waste.

Id. at 1266. The outcome of the decision may have been different if the Court had not misread the second criterion. The second criterion is key to the application of the NWPA as waste is not so “highly radioactive” or of “sufficient concentration” if the waste material is suitable for land disposal under Part 61. This criterion contrary to the Court’s opinion has independent meaning. It requires DOE to perform a performance assessment to determine if the performance objectives of Part 61 are met.

DOE appealed this case before the ninth circuit. The ninth circuit vacated the case on the basis it was not ripe for judicial review. NRDC v Abraham, 388 F.3d 701 (9th cir 2004). In so doing the Court did not reach the merits and the case does not serve as a legal precedent. The authors expect that DOE will be considering the lessons from this litigation as it updates Order 435.1.

13. Section 3116

As a result of the NRDC litigation, Congress enacted Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal year 2005 (NDAA) that codifies incidental waste criteria and provides a process for determining when waste as not HLW in South Carolina and Idaho. In essence Section 3116(a) provides that high-level radioactive waste does not include radioactive material resulting from reprocessing of spent nuclear fuel that the Secretary of Energy determines –

- (1) Does not require permanent isolation in a deep geologic repository ...
- (2) Has had highly radioactive radionuclides removed to the maximum extent practical; and
 - A. Does not exceed concentration limits for Class C low-level waste (LLW) and will be disposed of in compliance with the performance objectives in 10 CFR Part 61, Subpart C; or
 - B. Exceeds concentration limits for Class C LLW but will be disposed of in compliance with the performance objectives of 10 CFR Part 61, Subpart C, and pursuant to plans developed by DOE in consultation with the NRC

In August 2007, the NRC Staff issued NUREG-1854, NRC Staff Guidance for Activities Related to U.S. Department of Energy waste Determinations. This NUREG addresses NRC’s review of

waste determinations for WIR under DOE Order 435.1, Section 3116, and the NRC West Valley Criteria. The Staff in NUREG-1854 notes that the criteria contained in Section 3116 for determining that waste is not HLW are similar to the WIR criteria that NRC had previously used. NUREG-1854 at xxi. However, unlike DOE Order 435.1 and the NRC West Valley criteria, which permit DOE to meet requirements comparable to the performance requirements of Part 61, Section 3116 requires the performance objectives of Part 61 to be met. It is noteworthy that Section 3116 addresses Class C concentrations but does not set it as an absolute limit in that concentrations can exceed Class C if the performance objectives of Part 61 are met after appropriate consultations with the NRC.

III. Bases for the Part 7x Definitions

1. Definition of HLW

Part 7x provides definitions for both HLW and WIR. It defines HLW as:

the highly radioactive material resulting from recycling of spent nuclear fuel, including liquid wastes produced directly in recycling (i.e., liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent) and any solid material derived from such liquid waste that contains fission products in sufficient concentrations. HLW does not include waste incidental to recycling.

This definition is based on the language of the definition of HLW in the NWPA and AEA. Three changes were made to the statutory language. First, for consistency with Part 7x the term “reprocessing” was replaced with “recycling.” Second, a clarification of the phrase “liquid waste produced directly in recycling” was made by adding parenthetical language of “i.e., liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent.” The words in the clarification came from the definition of HLW in Part 60. As noted above, the Statements of Consideration for Part 63 noted that originally it used the words from the Part 60 definition that are the same clarifying words that is proposed in Part 7x but took them out to be more consistent with the EPA language that was similar to the NWPA. In so doing the Commission stated that there “is no substantial difference” between the definitions. 66 FR 55732 (November 2, 2001). The clarification is important because the new Part 7x directly addresses recycling. This clarification was added to signal where in recycling consideration begins that waste might be HLW. In our view it should have no effect on either expanding or contracting the scope of HLW for purposes of the NWPA or the AEA.

The third change in the definition is the inclusion of the statement that HLW does not include WIR. This exclusion is based on the definitions in the NWPA and the AEA that not all reprocessing waste is HLW. This is evident from the legislative history cited above addressing both source and the hazard and the resulting language in the statutory definitions that address “highly radioactive material resulting from the reprocessing” and “any solid material derived from such liquid waste that contains fission products in sufficient concentrations.” By adding the exclusion of WIR, the definition answers the fundamental questions of what is “highly

radioactive material resulting from the reprocessing” and what is “any solid material derived from such liquid waste that contains fission products in sufficient concentrations” (emphasis added). While the concept of WIR was created before the NWPA, it is used today to address when waste is not so “highly radioactive” or of “sufficient concentration” that it is not HLW. The Government position in the NRDC litigation is consistent with that view as it noted in that litigation that “the purpose of the WIR criteria is to determine whether solid reprocessing waste is ‘highly radioactive material’ and/or ‘contains fission products in sufficient concentrations’ so that it requires geologic disposal, 42 U.S.C. 10101(12), or whether such solid waste can instead be managed as low-level or transuranic waste.”¹⁴ Consequently, the proposed definition of HLW in Part 7x excludes WIR. This reflects DOE’s and NRC’s long track record of not including incidental waste as HLW.

2. Definition of WIR

Part 7x defines WIR as:

Waste material resulting from recycling of spent nuclear fuel, including liquid wastes produced directly in recycling and any solid material derived from such liquid waste that contains fission products that is not so highly radioactive or contains insufficient concentrations of fission products to be classified as HLW. Such waste is not so highly radioactive or of sufficient concentration if it (1) has been processed to remove key radionuclides to the maximum extent that is technically and economically practical, and (2) either meets Class C concentrations under 10 CFR part 61 or will meet the performance objectives in 10 CFR part 61, subpart C if disposed of in a near surface disposal site based on a site specific performance assessment. This definition does not relieve the Department of Energy from its responsibility for the disposal of radioactive material which is greater than Class C under the Low-Level Radioactive Waste Policy Act of 1985.

Having included the exclusion of WIR in the definition of HLW it was necessary to define it. This will be the first time that NRC addresses in its regulations the concept of WIR. While this may be controversial, there is no secret that NRC has and is using the WIR concept and the NRC made it clear in the West Valley Decommissioning Criteria in 2002 that incidental waste is not considered to be HLW. In addition, because the WIR concept is important to establish in developing the waste management aspects of the application for a recycling facility, it is included in the regulatory framework of Part7x to add stability to the regulatory process.

The first sentence of the definition defines in general terms that WIR is waste material resulting from recycling spent nuclear fuel that is not so highly radioactive or contains insufficient concentrations of fission products to be classified as HLW. This statement is consistent with the NWPA and the AEA. However, some may argue that the statement is over broad because it applies the “concentration sufficiency” concept to both liquids and solids. There is no intent to apply WIR to liquids as the concept of WIR is that such material is suitable for near surface land disposal under 10 CFR Part 61 which generally requires that waste to be disposed of be in solid

¹⁴ Appeal Brief at 42.

form to provide stability in accordance with 10 CFR 61.56. This is also consistent with the 1993 NRC WIR Criteria and DOE Order 435.1 both of which require WIR to be in solid form

The second sentence provides specificity derived from the Commission's 2002 West Valley Criteria and Section 3116. It contains two elements. The first element addresses economic and technical practicality from the West Valley criteria. This language was used rather than the somewhat broader language of Section 3116 that states "has had highly radioactive radionuclides removed to the maximum extent practical." Notwithstanding the language in Section 3116, NRC has taken the position in NUREG-1854 that DOE should consider both the technical and economic aspects of waste removal in demonstrating compliance with the criteria of Section 3116. The proposed language is also the language that the NRC has used throughout the development of its WIR criteria. The "practicality" element is important because it reduces the concentrations of the key radionuclides that affect dose to the public and intruders and reducing the radioactivity.

The second element provides a choice of two requirements. The first requirement provides that the waste must meet the Class C concentrations under Part 61. This is different from the criteria NRC adopted in the 2002 WIR criteria for West Valley and during the 2000 review of Savannah River tanks that focused on performance objectives and did not include a concentration as part of the WIR criteria. As former Chairman Meserve explained

this criterion was dropped because the Commission adopted a risk-informed and performance-based approach to meeting the performance objectives in Part 61 that focuses attention on the potential health consequences of leaving waste on-site (i.e., doses which might occur), rather than considering more indirect measures of health risk, such as meeting specific radionuclide concentration limits.¹⁵

It is also noted that while Section 3116 includes a Class C provision, as described above whether or not the waste meets Class C concentrations, the performance objectives of Part 61 must be met. However, it is important to recognize that the NRC criteria and Section 3116 addresses standards for disposing of WIR remaining in tanks on-site. Such sites have not been subject to a performance assessment demonstrating that the performance objectives have been met. It is not contemplated that waste from recycling will be disposed of on-site. Rather waste from recycling plants will need to be disposed of off-site at licensed disposal sites meeting the requirements of 10 CFR Part 61 or equivalent Agreement State regulations. Such sites in the authors' view are required by 10 CFR 61.12 and 13 to have demonstrated that the performance objectives of Part 61 will be met.

Consequently, class C waste was set as the threshold as waste that is within classes A, B, and C can be disposed of in a commercial LLW disposal site. See 10 CFR 61.55(a)(2)(iv). As just noted, sites accepting waste of classes A, B, and C must meet the performance requirements of Part 61. Class C waste is considered to be LLW and would need to be addressed if the site intends to accept such waste. Under such circumstances, the waste is not so "highly radioactive" or of "sufficient concentration" to require geologic disposal as near surface disposal will be protective of the public health and safety because the performance objectives will be met.

¹⁵ See footnote 11. See also John Greeves, response to NYSDEC at footnote 12.

Therefore, if the waste meet the requirements for the applicable license at the disposal site, it will not be necessary to provide a separate demonstration that the performance objectives are met as the disposal site would have already done one.

The second requirement of the second element provides for that assessment to demonstrate the public health and safety is protected for greater than Class C waste. Regardless of where the waste is disposed or its concentration and the waste acceptance criteria at a license site, if a site specific performance assessment demonstrates that the Part 61 performance objectives are met, then the disposal site is suitable for the waste. This is consistent with Section 3116 (a)(3)(B) and the Commission's view that

the "bottom line for disposal" of low-level radioactive wastes are the *performance objectives* of 10 C.F.R. Subpart C which set forth the ultimate standards and radiation limits for (1) protection of the general population from releases of radioactivity; (2) protection of individuals from inadvertent intrusion; (3) protection of individuals during operations; (4) and stability of the disposal site after closure.¹⁶

While the second element in itself is sufficient to demonstrate that the public health and safety will be protected based on the results of a site specific performance assessment, the first element addressing removal of radionuclides provides additional assurance. The resulting two elements if met, will provide reasonable assurance that the waste material will not need permanent isolation in a geologic repository as the waste is not so "highly radioactive" or of "sufficient concentrations."¹⁷

The last sentence in the definition is a statement concerning the responsibility of the Department of Energy for the disposal of radioactive material, which is greater than Class C under the Low-Level Radioactive Waste Policy Act of 1985.

3. Citation and Evaluation process

The proposed regulatory language submitted for Part 7x did not specifically address the WIR concepts of evaluation and citation used by DOE in its Order 435.1. These are important concepts as there is a clear distinction between the waste in a large waste tank that needs treatment to remove radionuclides in order to satisfy the performance objectives of Part 61 and smaller items that meets waste acceptance criteria for a LLW disposal site with no or minimum effort for treatment. The evaluation process would address tank waste and large items by applying the proposed definite of WIR in 7x. The citation process would address smaller items by applying the waste acceptance criteria for LLW disposal sites. By meeting the waste acceptance criteria for a LLW disposal site there will be assurances that the performance objectives of Part61 are met. From an operational perspective it is important to have within the regulatory framework a citation process to address gloves, filters, clothing and other items that clearly meet LLW acceptance criteria for waste management efficiency. During the rulemaking process, inclusion of a citation process will be an issue that the NRC will need to address.

¹⁶ Louisiana Energy Services, L.P. (National Enrichment Facility), CLI-05-05, at Page 11 (January 18, 2005).

¹⁷ See also Section 2.5.1 of NUREG -1854.

IV. Conclusion

In the authors' view, there is a clear basis for distinguishing material that is HLW and WIR based on regulatory and legislative history which is supported by the public health and safety.

HLW is only that radioactive waste from reprocessing that is "highly radioactive" and of sufficient concentration." Such waste is not suitable for near surface disposal. If radioactive waste meets the performance objectives of 10 CFR Part 61 when disposed of at a near surface disposal site, then the waste regardless of its source is not so "highly radioactive" or of "sufficient concentration" that disposal in a geologic repository is needed. WIR is material from reprocessing that is not so "highly radioactive" or of "sufficient concentration" that geologic disposal is needed to protect the public health and safety.

The proposal to NRC for defining HLW and WIR submitted by NEI as part of the proposed Part 7x regulatory framework is consistent with these views.

References

Statutes

Atomic Energy Act of 1954, as amended, 42 USC 2011
Energy Reorganization Act of 1974, 42 USC 5801
Low-Level Radioactive Waste Policy Act of 1985.
Marine Protection, Research, and Sanctuaries Act of 1972, 33 USC 1402
Nuclear Waste Policy Act of 1982, 42 USC 10101
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10 CFR Part 60, Disposal of High-Level Radioactive Wastes in Geologic Repositories
10 CFR Part 61, licensing Requirements for Land Disposal of Radioactive Waste
10 CFR Part 63, Disposal of HLW in a Geologic Repository at Yucca Mountain, Nevada

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Miscellaneous Documents

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Letter from John Greeves to Paul Merges, NYSDEC, dated October 8, 2002; available at NRC ADAMS at ML022120257

NEI White Paper, Appendix A, Establishing the Regulatory Framework to License Fuel Recycling Facilities (December 24, 2008); available at NRC ADAMS at ML083590129.

NEI White Paper, High Level Waste Insights (November 12, 2009); available at NRC ADAMS at ML09303035.